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ABSTRACT

This historical study traces the development of an undergraduate program at Lowry Technical Training Center (LTTC) situated in the Lowry Air Force Base, Colorado, to train Air Force officers and enlisted personnel for the space operations career field. The report begins in the 1950s when Air Force Systems Command examined the concept of a manned vehicle for military missions in space. In 1972, LTTC began a small training effort in space operations careers. In 1982, the Air Force Space Command was formed due to increased dependence on space systems for communications and national security. The Air Force subsequently introduced undergraduate space training at LTTC as part of an integrated approach in a program which involved general instruction with simulators by Air Training Command, specific systems training by the Air Force Space Command, and on-the-job training at the unit level. Efforts at revising the undergraduate space training curriculum are described, along with plans for the future. The report also includes reference notes accompanying each chapter, a chronology of important events in the program's development, a glossary, and a list of space operations organizations at Lowry AFB. (JDD)

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LTTC SPECIAL STUDY

THE DEVELOPMENT OF AIR FORCE UNDERGRADUATE SPACE TRAINING

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LTTC SPECIAL STUDY

THE DEVELOPMENT OF AIR FORCE UNDERGRADUATE SPACE TRAINING

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PREFACE

Since 1972, Lowry Technical Training Center has been training Air Force officers and enlisted personnel for the space operations career field. Over the course of that period, Air Force officials recognized that outer space was another dimension for military operations, similar to the land, sea, and air. The courses being taught at Lowry were in response to the Air Force's more active space mission.

In 1986, Air Training Command formalized this training in a new undergraduate program, Undergraduate Space Training. This special historical study traces the development of that program at Lowry.

I wish to express my thanks to the many people of the 3400th Technical Training Wing and 3301st Space Training Squadron who supplied key documents, answered questions, interpreted source materials, and read the narrative in draft form. Sgt Dawn A. Wilson, Assistant Lowry Historian, helped with the research and editing of this study. The documents used to prepare this study and cited in the "Notes" sections are maintained in the Lowry History Office.

Michael H. Levy
Center Historian
January 1990

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V-2 Space Operations Staff Officer Course: Units and Hours...50

CHRONOLOGY

1 Mar 1972	HQ Air Training Command (ATC) moved Defense Support Program training from Keesler to Lowry Technical Training Center (LTTC), and activated at Lowry Detachment 1 of Keesler's 3414th Instructor Squadron. This marked the beginning of space operations training at LTTC (p 2).
1 Sep 1973	HQ ATC inactivated Detachment 1, 3414th Instructor Squadron, at Lowry. In its place, the newly-activated 3447th School Squadron provided Defense Support Program training (p 3).
7 Sep 1977	HQ ATC published a plan to consolidate Space Systems Equipment Specialist/ Technician (AFSC 308X0) training at Lowry (pp 3-4).
2 Nov 1977	HQ USAF notified HQ ATC that the DOD approved shifting instruction for the Navy's Defense Meteorological Satellite Program from Keesler to Lowry. Training began at Lowry on 23 Jan 1978 (p 4).
24 Feb 1982	HQ ATC designated Lowry as the prime training center for the Operational Control Segment of the Global Positioning System, involving 13 operator and maintenance courses for AFSC 308X0 personnel (p 9).
20 May 1982	HQ ATC selected Lowry as the prime center for AFSCs 277X0 and 309X0

	training. In October 1983, LTTC began the new 277X0 Space Systems Operations training and introduced consolidated 309X0 Space Systems Equipment training (p 9).
7 Jun 1982	HQ ATC shifted the primary training authority for the Consolidated Space Operations Center from Keesler to Lowry (pp 9-10).
19 Jul 1982	HQ ATC decided to consolidate AFSC 20XX space operations training for officers and enlisted personnel at Lowry. The 3422nd Technical Training Squadron began instruction on 9 November (p 10).
1 Sep 1982	The Air Force established HQ Air Force Space Command at Peterson AFB to provide a central authority for managing space operations (p 8).
1 Jul 1984	HQ ATC inactivated Detachment 1, 3422nd School Squadron, and replaced it with the 3423rd Technical Training Squadron. The 3423rd conducted space operations training at Peterson AFB (p 11).
1 Oct 1984	HQ ATC activated the 3430th Technical Training Group at Lowry for the space operations mission (p 11).
23 Sep 1985	The DOD activated HQ United States Space Command at Peterson AFB to provide a unified military space command (p 12).
15 Nov 1985	HQ USAF made ATC responsible for the new Category I Undergraduate Space Training

	to be introduced at Lowry in 1986 (p 18).
2 Jan 1986	HQ ATC and HQ Air Force Space Command established a Training Development Office at Colorado Springs to devise the Undergraduate Space Training curriculum. The office became Detachment 2, 3430th Technical Training Group (p 20).
12 Sep 1986	Lt Col Donald F. Craigie took command of the 3430th Technical Training Group (p 20).
9 Oct 1986	Beginning Undergraduate Space Training at Lowry marked the start of a new Air Force undergraduate program (pp 21-22).
20 Feb 1987	The first class of 25 officers graduated from Undergraduate Space Training (p 33).
1 Apr 1987	As part of a realignment of staff agency functions, HQ ATC shifted Undergraduate Space Training from its Deputy Chief of Staff for Technical Training to the Deputy Chief of Staff for Operations and Readiness (p 24).
1 Jul 1987	HQ ATC activated the 3301st School Squadron at Lowry, under the command of Lt Col Ronald G. Forrester, formerly Chief of the 3430th Technical Training Group's UST Division. This marked the initial step in the progression of Undergraduate Space Training from division to squadron status (p 24).

1 Oct 1987	HQ ATC inactivated the 3301st School Squadron at Lowry and replaced it with the 3301st Space Training Squadron (p 24).
20 Oct 1987	LTTC dedicated Building 408 as the Major Laurence L. Ballard Jr. Space Training Complex (pp 25-26).
15 Dec 1987	HQ ATC inactivated Detachment 2, 3430th Technical Training Group (pp 24-25).
24 May 1989	Lt Col Joseph D. Dumoulin assumed command of the 3301st Space Training Squadron (p 48).

CHAPTER I

LOWRY GAINS A SPACE OPERATIONS MISSION

Introduction

For over 50 years, Lowry Technical Training Center (LTTC) has provided the armed forces with technicians to operate and maintain weapon systems and support equipment. Beginning in 1972, LTTC supported an emerging Air Force role in outer space with courses that prepared officers and enlisted personnel for careers in space operations. What began as a small training effort eventually became a major career field for the United States Air Force (USAF) and a new undergraduate training program for Air Force officers.

During the administrations of Presidents Dwight D. Eisenhower (1953-1961) and John F. Kennedy (1961-1963), HQ Air Force Systems Command (AFSC) examined the concept of a manned vehicle for military missions in space, assigning the project to its Aeronautical Systems Division at Wright-Patterson AFB, Ohio. Of particular concern to the DOD was the perceived vulnerability of American reconnaissance satellites both to their Soviet counterparts orbiting in space and to Soviet offensive nuclear weapons. USAF strategists promoted the manned X-20 Dyna-Soar as a potential military weapon system, but political events in the aftermath of the Cuban missile crisis of October 1962 undermined the justification for Dyna-Soar as a vehicle for launching nuclear weapons in space and destroying satellites.[1]

After the Cuban missile crisis, Soviet and American political leaders worked to improve relations between their nations. They particularly wanted to avoid an arms race in

space. In 1963, the United States and the Soviet Union accepted the principle of mutual satellite reconnaissance and concluded a Limited Nuclear Test Ban Treaty to end the testing of nuclear weapons in outer space, in the atmosphere, and underwater. Consequently, on 10 December 1963, the administration of President Lyndon B. Johnson cancelled the Dyna-Soar program. Two decades passed before the National Aeronautics and Space Administration's (NASA) space shuttle offered the Air Force another vehicle for military operations in space.[2]

The Defense Support Program

Space operations training at Lowry originated with a program conducted by Keesler Technical Training Center (KTTC). In 1970, Headquarters Air Training Command (HQ ATC) assigned the Defense Support Program (DSP) to its Mississippi training center. The Aerospace Defense Command, with headquarters at Ent Air Force Base (AFB), Colorado, operated a classified space-based detection and communications system called the DSP. In conducting instruction for the program, Keesler also used the California plants of the Philco-Ford and Aerojet General Corporations.[3] When HQ ATC shifted the training to Denver, Colorado, on 1 March 1972 by activating at Lowry Detachment 1 of Keesler's 3414th Instructor Squadron, this marked the start of space operations training at LTTC.[4]

Keesler initially gained responsibility for the DSP because the Communications-Electronics Doctrine Project Office was part of its mission, but conducting the training through a detachment from the Mississippi training center was an unsatisfactory arrangement. This organizational setup complicated management support for a program that was receiving increasing attention from the Air Staff and the Office of the Secretary of Defense. The commander of Detachment 1, a major, negotiated with more senior officers, at times general officers. Moreover, AFSC's development officials often did not take training requirements into account when they approved hardware and software changes to

an operational system. For these reasons, the KTTC Commander favored transferring his Center's DSP duties to LTTC.[5]

On 17 May 1973 Maj Gen Frank M. Madsen Jr, ATC's Deputy Chief of Staff for Technical Training, proposed shifting responsibility for the DSP to LTTC.[6] Maj Gen Alton D. Slay, the Lowry Commander, agreed with this action and suggested the formation of a separate technical training squadron to conduct the program at his center. General Slay contended that a squadron offered the essential "front office support and visibility" for a successful program.[7]

HQ ATC inactivated Detachment 1, 3414th Instructor Squadron, at Lowry on 1 September 1973. In its place, the newly-activated 3447th School Squadron (SCHS) provided DSP training.[8] Shifting program responsibility from Keesler to Lowry occurred in an orderly manner. With the personnel already located at ATC's Denver base, the move involved primarily files, records, and documents. The 3447 SCHS was redesignated on 30 April 1976 as the 3422 SCHS, and on 1 April 1977 as the 3422nd Technical Training Squadron (TCHTS).[9]

Expanding Lowry's Space Operations Mission

Keesler's mission included the Defense Meteorological Satellite Program (DMSP), the Department of Defense's (DOD) weather satellite system. Because this training was similar to that for Lowry's DSP, the Air Force in 1977 decided to merge both specialties. HQ Air Force Military Personnel Center (AFMPC) converted the Air Force Specialty Code (AFSC) 302X0 DMSP technician to AFSC 308X0, Space Systems Equipment Specialist/ Technician, and HQ ATC centralized all 308X0 training at Lowry.[10]

In September 1977 HQ ATC published a plan for consolidating 308X0 training at Lowry. In preparing the plan, ATC officials assumed that the reorganization would include training for the

Navy's DMSP at Keesler. On 2 November, HQ USAF notified HQ ATC that the DOD had approved shifting instruction for the Navy's DMSP to Lowry.[11]

Lowry added three enlisted positions from Keesler to its 14 DSP 308X0 authorizations. The consolidation plan provided for transferring training equipment and related documentation.[12] Lowry introduced a basic-level airman's course for the new 30830/50/70 career field in 1978. Airmen completing the course reported for duty with the Aerospace Defense Command, Air Weather Service, or Strategic Air Command. The new Space Systems Equipment Specialist course provided training on space systems command and control equipment.[13]

Space operations became the mission of Lowry's 3422 TCHTS. The Operator/Programmer Training Branch and the Maintenance Training Branch offered courses in equipment for automated data processing, ground and satellite monitoring, mission displays, ground communication, and teleprocessing; teletypewriters; and computers. These courses ranged in length from 5 days to 166 days.[14]

Navy DMSP training at Lowry began on 23 January 1978, and the 3422 TCHTS subsequently established a Navy Training Branch. Later, Army and Marine Corps personnel came to Lowry for DMSP training. Navy personnel received instruction on the AN/SMQ-10 meteorological tracking station; the Air Force, Army, and Marine Corps used the MK III and IV transportable terminal.[15]

By the end of 1978, there were 61 military and civilian personnel assigned to the 3422 TCHTS. Although complete figures are lacking, the Operator/Programmer Training and Maintenance Training Branches graduated at least 144 people in fiscal year (FY) 1978. The number of graduates for the Navy Training Branch were not available.[16]

NOTES - CHAPTER I

1. Roy F. Houchin, II, "The Diplomatic Demise of Dyna-Soar: The Impact of International and Domestic Political Affairs on the Dyna-Soar X-20 Project, 1957-1963," Aerospace Historian (Winter/ December 1988) 35:4, pp 274-280.

2. Ibid.

3. History of Keesler Technical Training Center, 1 Jul 70-30 Jun 71, I, p 17, subsequently referred to as KTTC Hist; Msg, HQ ATC to Multiple Addressees, subj: Defense Support Program Training Support Conference, 222102Z Jul 70; History of Lowry Technical Training Center, 1 Jul 73-30 Jun 74, I (FOUO), p 9 (material used is not FOUO), subsequently referred to as LTTC Hist; Brfg, [ATC sp sys tng, Oct 83].

4. ATC SO G-44, 22 Feb 72.

5. Msg, HQ ATC to LTTC/CC, subj: Transfer of Defense Support Program (DSP) Training Responsibility, 172240Z May 73.

6. Ibid.

7. Msg, LTTC/CC to ATC/TT, subj: Transfer of Defense Support Program (DSP) Training Responsibility, 082200Z Jun 73; Memo, Col C.L. Boyd, USAFSAAS/TT, to LTTC/CC, subj: Training in R199125 and Defense Support Program (DSP), 13 Jul 73.

8. ATC SO G-350, 15 Aug 73.

9. KTTC Hist, 1 Jul 73-30 Jun 74, I, p 51; History of the 3422 SCHS, 1 Jan 76-30 Jun 76; Ltr, ATC/XPMO to Multiple Addressees, subj: Reorganization of ATC Centers, 27 Feb 76; ATC SO G-57, 10 Feb 77.

10. History of Air Training Command, 1977, I (FOUO), p 173 (material used is not FOUO), hereinafter cited as 1977 ATC Hist; LTTC Hist, 1 Jan-31 Dec 77, I (FOUO), p 17 (material used is not FOUO); ATC PAD 10-77, ATC/XPXP, subj: Consolidation of Space Systems Equipment Training at Lowry Air Force Base, 7 Sep 77, p 2, hereinafter cited as ATC PAD 10-77.

11. ATC PAD 10-77, p 2; Msg, HQ USAF/PRPC, to ATC/TTK, subj: Relocation of Naval Defense Meteorological Satellite Program (DMSP) Training to Lowry AFB, CO, 211302Z Nov 77.

12. ATC PAD 10-77, pp B-1 & 2, T-1 & 2.

13. 1977 ATC Hist, I (FOUO), p 173 (material used is not FOUO); LTTC Hist, 1 Jan-31 Dec 77, I (FOUO), p 17, (material used is not FOUO).

14. History of the 3422nd TTS, 1 Jul 78-31 Dec 78; LTTC Hist, 1 Jan-31 Dec 88, I (PV), pp 189-190, (material used is not PV).

15. See note above; Brfg, [LTTC sp tng progs, 1982].

16. See note 14.

CHAPTER II

THE AIR FORCE ESTABLISHES AN OPERATIONAL SPACE COMMAND

Introduction

The Air Force's involvement in space activities was primarily concerned with communications, weather, and early warning satellites. The service lacked a central authority for managing military space operations and for evaluating these activities from an operational point of view. By the 1980s, Air Force officials recognized the need for a more coherent strategy that prepared their service for an expanding military mission in space. They saw the vast realm of outer space as "another dimension," one similar to the land, sea, and air. A more active Air Force role in space, including a separate space command, could further the nation's strategy of deterrence while enhancing international stability.[1]

Forming an Air Force Space Command

The Soviet Union had a comprehensive military space program. In the 1970s, the Soviets launched approximately five times as many satellites as the United States. In 1981, they launched 75 satellites with a military mission while the United States sent up only 8. The Soviet antisatellite system represented a potential threat to America's low-orbiting satellites. Soviet research and development was another area of concern. It included a large booster rocket capable of supporting a weapon for use against geostationary satellites; a ground-based electronic warfare system; and a high-energy laser program. In addition, the Air Force regarded the substantial Soviet manned

space program as further evidence of that nation's awareness that operating in space offered advantages for command and control, surveillance, target selection, and maintenance of space systems.[2]

The American dependence on space systems for communications and national security increased. Satellites facilitated long-distance communications; provided early warning against attacks by intercontinental ballistic missiles; furnished the military services with weather data; and offered accurate navigation to land, sea, and aerospace vehicles with the Global Positioning System (GPS). At a space shuttle launching on 4 July 1982, President Ronald W. Reagan stated that national security was a major goal of the nation's space program. On 1 September, the Air Force established HQ Air Force Space Command (AFSPACECOM) at Peterson AFB, Colorado, under the command of Gen James V. Hartinger.[3]

AFSPACECOM received operational responsibility for the Satellite Early Warning System and the DMSP. The new command had a three-fold charter. Because surveillance was essential to operating in space, AFSPACECOM detected, tracked, and cataloged all manmade objects moving through space; these numbered about 4,800. Radar sensors identified the objects and determined those capable of reentering the earth's atmosphere. The surveillance function included protecting American satellites (maneuvering, countermeasures, and component hardening).[4]

The second major task was collision avoidance. This encompassed providing information about the location of space objects in support of space missions, laser experiments, and flights of the space shuttle. The third major task concerned the as yet undefined area of antisatellite systems.[5]

Refining Space Operations Training

With a new approach to space operations, the Air Force

centralized much of this training at LTTC and the Center received additional taskings. On 24 February 1982, HQ ATC designated Lowry as the prime training organization for the Operational Control Segment of the GPS. This involved 13 operator and maintenance courses for 308X0 personnel. Although ATC did not have a direct role in GPS activities, the command exercised an indirect one through Lowry's training for the Integrated Operational Nuclear Detonation Detection System. The Air Force planned to deploy the detection system on some GPS satellites in conjunction with the Operational Control Segment.[6]

The Air Force wanted to consolidate the training for AFSCs 308X0 and 309X0 (Missile Warning and Space Surveillance Sensor personnel) by the fall of 1982. Accordingly, ATC transferred the former 308X0 Space System Equipment Training technicians to the existing 309X0 Equipment Maintenance AFSC. The 308X0 Space Systems Command and Control technicians became 277X0, and the 308X0 AFSC was eliminated. Brig Gen Thomas J. Hickey, the command's Deputy Chief of Staff for Technical Training, recommended conducting all 309X0 and 277X0 training at Lowry. This involved transferring some modules and test equipment from Keesler to Lowry.[7]

On 20 May 1982, Maj Gen William P. Acker, ATC's Vice Commander, selected Lowry as the prime center for 277X0 and 309X0 training.[8] In October 1983, LTTC introduced the new 277X0 Space Systems Operations training based on the old 308X0 Space Systems Equipment training. That same month, Lowry began consolidated 309X0 Space Systems Equipment Maintenance training that combined its 308X0 training with KTTC's 309X0 training.[9]

General Acker further enlarged Lowry's space operations mission by shifting primary training authority for the Consolidated Space Operations Center (CSOC) from Keesler to Lowry on 7 June 1982. Conceived as part of the Air Force Satellite Control Network, the projected CSOC would plan and control DOD space shuttle and satellite missions. ATC's Denver center already provided instruction on the IBM Series 370/Model 3033

computer, to be used for CSOC. Moreover, Lowry supported the DSP and DMSP and was developing a training program for the GPS. General Acker therefore concluded that LTTC could better support the CSOC.[10]

On 19 July 1982, the ATC Commander, Gen Thomas M. Ryan, Jr., decided to consolidate AFSC 20XX space operations training for officers and enlisted personnel at Lowry. KTTC conducted this training at Peterson AFB, Colorado, but Peterson was unable to support increased training requirements for the career field. In view of Lowry's extensive space operations programs, General Ryan concluded that it was in the command's "best interest" to transfer 20XX training to Lowry's 3422 TCHTS, with instruction beginning in November 1982. The move involved 11 manpower authorizations and the reference materials, training aids, and documents for nine courses: four space operations officer courses and five space operator enlisted courses. On 9 November, the 3422 TCHTS began instruction in the first course, Space Environment and Operations, with 31 officers; the class graduated on 16 December.[11]

Detachment 2 of Keesler's 3390th Technical Training Group (TCHTG) continued to operate at Peterson AFB but in a reduced role, with one operations, four maintenance, and seven computer programmer courses. The detachment provided training for the North American Air Defense Command's (NORAD) Cheyenne Mountain Complex and the Tactical Warning/Attack Assessment System Familiarization course for senior officers.[12]

In 1983 HQ ATC shifted management responsibility for Detachment 2 from Keesler to LTTC. Geographic proximity to Colorado Springs enabled Lowry to better support Space Command training requirements, including the Cheyenne Mountain Complex. Lowry's location, in contrast to Detachment 2's separation from KTTC, offered particular benefits for providing management support and reducing temporary duty travel expenditures. Other factors in Lowry's favor included the Center's extensive space

operations training and the effort to organize a technical training group for that training.[13]

On 1 July 1983, HQ ATC inactivated Detachment 2 and in its place activated Detachment 1 of Lowry's 3422 SCHS. (On 1 October 1982, HQ ATC redesignated the 3422 TCHTS as the 3422 SCHS.) Also on the same day, the command activated at Sunnyvale Air Force Station (AFS), California, Operating Location A (OL-A) of Lowry's 3400th Technical Training Wing (TCHTW). OL-A personnel represented the command at the Air Force Satellite Control Facility, supervised contractor-developed computerized instruction for the Satellite Operations Complex, and prepared computerized instruction for the CSOC communication satellite course.[14]

Further organizational changes the following year reflected the expanding nature of Lowry's space operations training. On 1 July 1984, HQ ATC inactivated Detachment 1 of the 3422 SCHS and replaced it with the 3423 TCHTS. The new squadron reported to the commander of the 3400 TCHTW pending formation of a separate technical training group for space operations. The latter action occurred on 1 October, when HQ ATC activated the 3430 TCHTG at Lowry, with control over the 3423 TCHTS. In addition, the command elevated OL-A at Sunnyvale AFS to Detachment 1 of the 3430 TCHTG. The 3430th also gained a new unit, OL-B, at the Johnson Space Center, Texas.[15]

The formation of Lowry's newest technical training group was further evidence of the importance of Air Force space operations training. The 3430th had two divisions giving entry-level instruction for officers and airmen manning satellite and space shuttle control consoles. The Space Operations Training Division provided officer training (20XX) for Space Operations Analysts, Space Systems Operations Officers, Manned Space Flight Operations Officers, and Satellite Operations Officers; plus enlisted training for specialists in Space Systems Operations (277X0), Aerospace Control and Warning Systems (276X0), and Electronic Intelligence Operations (205X0). The Space Programmer/

Maintenance Training Division instructed officers (51XX) as computer programmers for the DSP, and enlisted personnel in three AFSCs: Electronic Computer and Switching Systems (305X4), Electronic Communications and Cryptographic Systems (306X0), and Space Systems Equipment Maintenance (309X0).[16]

In FY 1984, the 3430 TCHTG's 67 instructors taught 33 courses and trained 973 officers and enlisted personnel. In the same year, the group's 3423 TCHTS had 16 instructors teaching 14 courses to 1,358 people.[17] With the 3430th now responsible for the mission of the 3422 SCHS, HQ ATC inactivated that unit on 31 March 1985.[18]

Activating the United States Space Command

Space operations were important to the United States militarily for reconnaissance and communications, and the DOD recognized that outer space would be a more strategic operational theater in the years ahead. In December 1984, the Reagan Administration decided to establish a unified space command to coordinate space operations for the nation's military services. On 23 September 1985, the DOD activated the United States Space Command (USSPACECOM) with headquarters at Peterson AFB.[19]

ATC's training programs supported both the AFSPACECOM and the USSPACECOM. In 1986, ATC and AFSPACECOM agreed on a division of training responsibilities for space operations. ATC offered basic programs to prepare personnel for operational assignments; AFSPACECOM provided training for specific missions, upgrade training, and on-the-job training.[20]

NOTES - CHAPTER II

1. Aerospace Speech 83-7, SAF/PA, Gen James V. Hartinger, AFSPACECOM/CC, to Paul Revere Foundation, Wichita, Kan, subj: The New Space Command, 1 Dec 82, hereinafter cited as Hartinger speech.

2. Ibid.

3. Ibid; Brfg, [ATC sp sys tng, Oct 83].

4. Hartinger speech.

5. Ibid.

6. Brfg, [LTTC sp tng progs, 1982]; Ltr, Maj Gen William P. Acker, ATC/CV, to KTTC/CC & LTTC/CC, subj: Realignment of Center Responsibility in the Global Positioning System (GPS) Program, 24 Feb 82.

7. Brfg, [LTTC sp tng progs, 1982]; Ltr, Brig Gen Thomas J. Hickey, ATC/TT, to KTTC/CC & LTTC/CC, subj: Consolidation of AFSCs 308X0 and 309X0, 7 Apr 82; Intvw, Mr Michael H. Levy, LTTC/HO, w/Mr Mack F. Page, 3400 TCHTW/TTOS, 30 Nov 89, subsequent interviews cited as Levy/person being intvwd

8. Ltr, Maj Gen Acker, ATC/CV, to KTTC/CC & LTTC/CC, subj: Consolidation of AFSC 308X0 and 309X0 Training, 20 May 82.

9. Brfg, [ATC sp sys tng, Oct 83].

10. Brfg, [LTTC sp tng progs, 1982]; Ltr, Maj Gen Acker, ATC/CV, to Multiple Addressees, subj: Designation of Prime and Associate Center Responsibilities for the Consolidated Space Operations Center (CSOC), 7 Jun 82; Consolidated Space Operations Center (CSOC) Training Program Development Management Plan (TPDMP), 31 May 84, pp 1 & 4.

11. Ltr, Gen Thomas M. Ryan, Jr, ATC/CC, to KTTC/CC & LTTC/CC, subj: Consolidation of Space Operations Training, 19 Jul 82, hereinafter cited as Ryan ltr, 19 Jul 82; Ltr, Brig Gen Hickey, ATC/TT, to ATC/XP, subj: Transfer of Space Operations Training, 19 Jul 82, hereinafter cited as Hickey ltr, 19 Jul 82; ATC PGL, ATC/XP, subj: Relocation of AFSC 20XX, Space Operations Training, and Related Training, from Peterson AFB CO to Lowry AFB CO, 13 Aug 82, pp 1-2, hereinafter cited as ATC/XP PGL, 13 Aug 82; Pt Ppr, subj: Space Operations Training Courses transferred from Detachment 2 to LTTC in September 1982, [c. Mar 83]; Ltr, Maj Gen William R. Usher, LTTC/CC, to Gen Ryan, ATC/CC, Subj: ["how goes it"], 4 Jan 83.

12. ATC/XP PGL, 13 Aug 82, p 2; Ryan ltr, 19 Jul 82; Pt Ppr, subj: Current Training Programs Conducted by Det 2, 3390 TCHTG, [c. Mar 83].

13. Pt Ppr, subj: Rationale for Transferring Management Responsibility for Det 2, 3390 TCHTG (KTTC) to LTTC, [Mar 83]; Ltr, Brig Gen Hickey, ATC/TT, to KTTC/CC & LTTC/CC, subj: Transfer of Responsibility for Det 2, 3390 TCHTG, 19 Apr 83; SSS, Col Rodney B. Beckman, 3400 TCHTW/CV, to LTTC/CC, subj: Transfer of Responsibility for Detachment 2, 3390 TCHTG (HQ ATC/TT Ltr, 19 Apr 83), 22 Apr 83; Ltr, Maj Gen Usher, LTTC/CC, to ATC/TT, subj: Transfer of Responsibility for Det 2, 3390 TCHTG, (Your ltr, 19 Apr 83), 29 Apr 83.

14. ATC SOs: G-205 & 206, 15 Jun 83, & G-211, 16 Jun 83; 1983 LTTC Hist, I (PV), p 105 (material used is not PV); ATC SO G-376, 21 Sep 82.

15. Ltr, Col Donald W. Swain, 3400 TCHTW/CC, to ATC/TTQ/TTY, subj: Establishment of 34XX Technical Training Squadron for Space Systems at Colorado Springs, Colorado, 12 Mar 84; ATC SOs: G-127, 22 May 84, G-145, 6 Jun 84, G-282, 14 Sep 84, G-302, 303 & 305, 28 Sep 84.

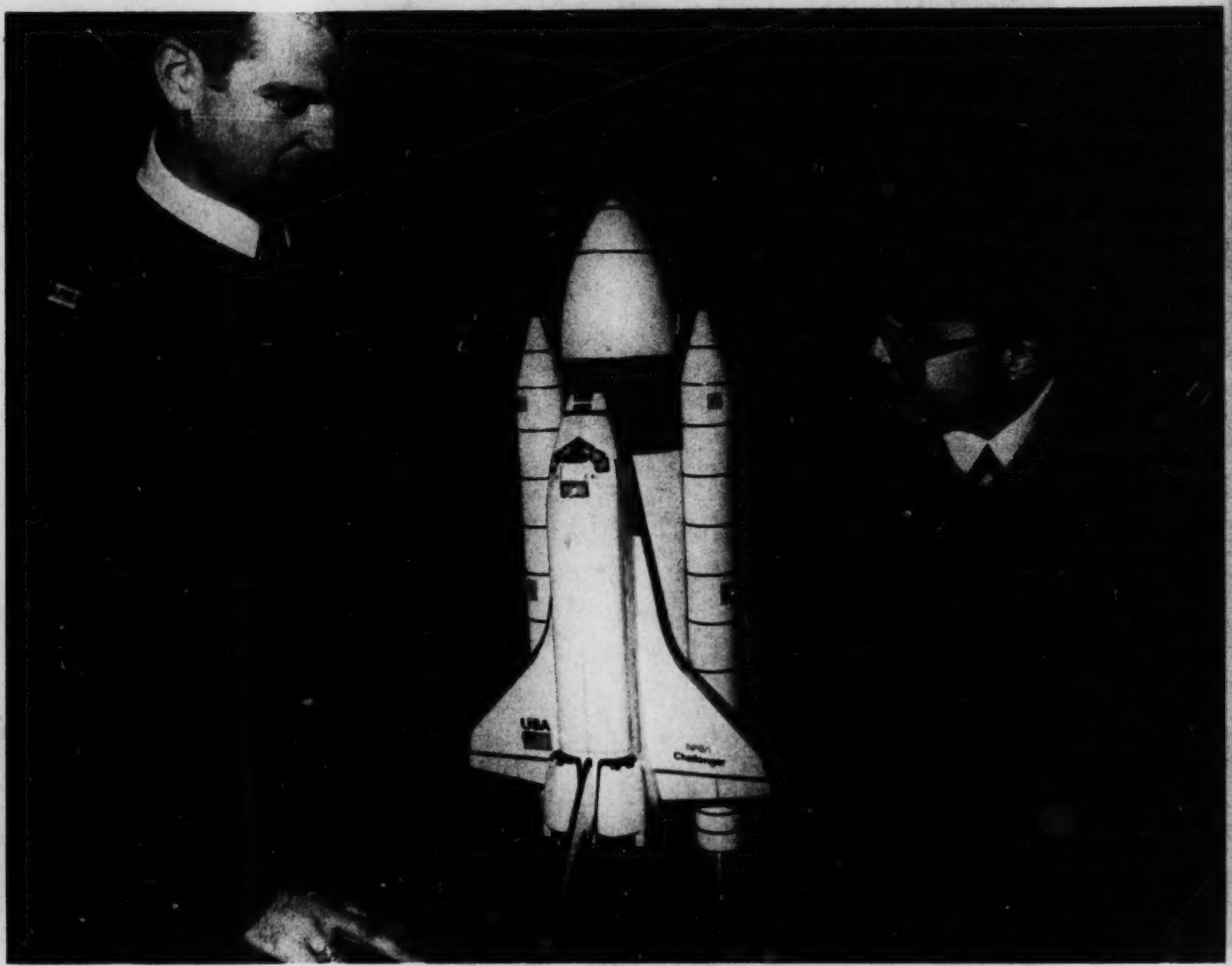
16. Tlkg Ppr (Draft), 3400 TCHTW/TTGXS, subj: ATC/Space Command Training Interface, 7 Jun 85; Brfg, Capt Curtis Converse, 3430 TCHTG, subj: [3430 TCHTG organ and tng], 6 Nov 84, hereinafter cited as Converse Brfg, 6 Nov 84.

17. Converse Brfg, 6 Nov 84.

18. ATC SO G-88, 19 Mar 85.

19. 1985 ATC Hist, I (PV), p 201 (material used is not PV).

20. 1986 ATC Hist, I (PV), pp 201-203 (material used is not PV).



UST instructors use a model of the Challenger space shuttle to teach students about United States and foreign space launch vehicles. (Base Photo Lab, Dec 1989)

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CHAPTER III

INTRODUCING AIR FORCE UNDERGRADUATE SPACE TRAINING

Introduction

In the early 1980s, LTTC was becoming ATC's primary center for space operations training. The requirements for trained personnel had increased and Peterson AFB was unable to support the increased workload for Keesler's detachment. Through an initial agreement in 1982 between ATC and KTTC, and subsequent agreements between AFSPACECOM and ATC, Lowry conducted 20XX academics and some 205X0 and 276X0 hands-on instruction for sensor and early warning systems. This consisted of the following courses: Mission Data Controller, Satellite/Ground Station Staff Officer, Space Systems Console Operator, Space Systems Director, Space Object Identification Analyst and Technician, as well as training for the Ballistic Missile Early Warning System (BMEWS) and the PAVE PAWS and COBRA DANE radars.[1]

AFSPACECOM furnished the facilities and equipment for the courses, but the instruction did not always satisfy the command's operational requirements. Part of the program (the courses for BMEWS, PAVE PAWS, COBRA DANE, and Space Object Identification Analyst) sometimes lacked sufficient hands-on training. With ATC and AFSPACECOM sharing the training equipment, it was not always available to the students.[2]

Prior to 1986, LTTC trained Air Force space operations officers, but the Category I[3] initial skills 20XX courses (Space Environment and Operations, Space Systems Analyst, Manned Space Flight Operations Officer, Space Operations Officer, Satellite Operations Officer) were academic in nature and did not include

hands-on instruction. Future space operations officers received training in one specialty; for example, satellite operations or surveillance and warning. The training provided them with no overall concept of the space operations career field and how their job related to the whole field. Upon completing their Lowry training, these officers proceeded to HQ AFSPACECOM at Peterson AFB to continue preparing for their careers with Category II mission-oriented training.[4]

The Air Force needed a new approach to training its space operations officers, one that provided them with a broad education in the basic knowledge and skills applicable to the career field as a whole. In June 1985, ATC and AFSPACECOM officials agreed to develop a comprehensive program based on three principles: general instruction with simulators by ATC; specific systems training by AFSPACECOM; and on-the-job training at the unit level.[5]

Developing Undergraduate Space Training

The Air Force introduced Undergraduate Space Training (UST) at Lowry as part of an integrated approach to preparing officers for careers in space operations. These men and women served in several positions: Space Operations Staff Officer (2016), Space Operations Analyst (2025), Space and Missile Warning/Space Operations Officer (2035), Manned Spaceflight Operations Officer (2045), and Satellite Operations Officer (2055).[6]

In the fall of 1985 representatives from ATC, AFSPACECOM, and AFSC formulated a plan for space operations training. Published on 15 November, the document made ATC responsible for the new Category I UST program to begin at Lowry in 1986. The Air Force developed UST to train future Space System and Space Surveillance Operations Officers in all aspects of the career field instead of only one specialty. Lasting from five to six months, the course of study combined the space sciences with basic concepts of manned space flight, satellite operations, and

missile warning functions. Graduating officers with a broad background in space operations gave the Air Force greater flexibility in making personnel assignments.[7]

AFSPACECOM received authority for the Category II academic, simulator, and computerized instruction in command and control centers, space and missile warning sensors, satellite operations, and manned space flight control operations. The command's Combat Crew Training Squadrons (CCTS) prepared personnel for specific positions and missions. Afterwards, the students reported to their assignments and on-the-job certification at the Johnson Space Center in Houston, Texas; NORAD's Cheyenne Mountain Complex near Colorado Springs, Colorado; or spacetrack and missile warning sites throughout the world.[8]

The Air Force decided to implement UST at Lowry in three phases. Phase I development began in January 1986 and lasted until the start of academic classes in October 1986. Phase II was scheduled to continue until the introduction of computerized training equipment, at a date to be determined. Phase III would begin with the addition of simulator equipment, as students received more advanced training and worked at actual space operations procedures. Once the simulators and computerized equipment had been evaluated, UST would be completely ready for the space mission.[9]

With UST becoming the basis for formal space operations training, Lowry had to terminate its older resident 20XX space courses in Phase II. ATC and AFSPACECOM agreed to establish a Training Development Office at Colorado Springs in January 1986 to coordinate the introduction of their respective programs. Office funding became a joint obligation of the two commands, with ATC appointing the director of the office and AFSPACECOM the deputy director. Additionally, in January 1986 AFSPACECOM had to assume responsibility for Lowry's Category II sensor and early warning site-specific hands-on training.[10]

In December 1985 Maj Gen Larry N. Tibbetts, ATC's Deputy Chief of Staff for Technical Training, wrote to Maj Gen Joseph D. Moore, Lowry's Commander. General Tibbetts discussed Air Force activities for improving space training and provided a charter designating Lowry as ATC's "operating agent" for developing and implementing UST. This included providing the manpower and funding support for the Training Development Office and replacing the 20XX courses with UST. General Moore advised his Wing Commander, Col James C. Bobick, that UST was Lowry's first priority in technical training.[11]

The Training Development Office. ATC and AFSPACECOM established a Training Development Office at Colorado Springs on 2 January 1986, under the direction of Lt Col Donald F. Craigie. Colonel Craigie served in this capacity until 12 September 1986, when he was succeeded by his deputy, Maj Robert N. Ewell; Colonel Craigie became commander of Lowry's 3430 TCHTG on 15 September. Designated as Detachment 2, 3430 TCHTG, the Training Development Office and its 22-member staff devised the UST curriculum and the plans for using training equipment: computers, part-task trainers (training devices for simulating one function or part of a system), and simulation techniques.[12]

Training officials worked on developing a comprehensive instructional network for evaluating student comprehension of the UST subject matter and the ability to operate control consoles. Training equipment would be phased into the curriculum during 1987 and 1988. ATC, AFSPACECOM, and AFSC established an advisory committee to study how to use a computerized program of instruction. The committee also established standards for computerized instruction.[13]

The Training Development Office contracted with Eagle Technology, Incorporated, to provide computer specifications and sample lessons. Cardinal Management Associates received a contract to furnish a computer and three terminals to Eagle Technology for courseware development. In conjunction with the Federal Government's Office of Personnel Management, Eagle worked

on a model to meet simulation requirements. The Air Force Human Resources Laboratory, Brooks AFB, Texas, awarded a contract to Applied Science Associates to define the requirements for part-task training.[14]

On 16-17 January 1986, representatives from ATC and AFSPACECOM met in Colorado Springs to discuss their respective duties for space operations training. The participants agreed on transferring to AFSPACECOM the Category II courses taught by the 3430 TCHTG and the group's 3423 TCHTS located at Peterson AFB. The squadron prepared people for assignments with the Space Defense Operations Center, Satellite Operations Complex, and Shuttle Operations and Planning Complex, all located in the Colorado Springs area. AFSPACECOM's 1013 CCTS had to begin this training on 1 July and 1 October 1986.[15]

As part of the January agreement, signed in May, Lowry acquired 51 manpower positions for UST from the 3423 TCHTS. The 1013 CCTS had to introduce a course for space operations staff officers; begin supporting initial operational test and evaluation for the Space Defense Operations Center and the CSOC on 1 May 1986; and continue the 3423rd's duties for the CSOC and the Attack Warning/Attack Assessment courses, with the transfer of 13 personnel from the 3423rd to the 1013th.[16]

The 3430 TCHTG had to terminate its five 20XX Category I space operations courses and replace them with UST, to begin on 9 October 1986. The group suspended the 20XX courses effective 1 October 1986, except for 2001 and 2031. The last 2001 and 2031 courses began on 20 November and 10 December, respectively.[17]

The UST Curriculum

On 5 May 1986 Gen Robert T. Herres, Commander of AFSPACECOM, endorsed the tentative course training standard, course topics, and class hours for UST. HQ ATC approved the course training standard on 12 August and the training plan on 25 August. When 25 officers started classes on 9 October, this marked the

beginning of a new undergraduate program for the Air Force. UST was modeled after the Air Force's undergraduate programs for pilots and navigators.[18]

Lack of computer hardware and software for the initial classes restricted instruction to academics only. The program comprised 578 hours (increasing to 656 hours when equipment for hands-on training was added) and lasted 82 days. ATC officials recognized the need for combining the academic and computerized training. Lowry officials expected to begin introducing training equipment during 1987.[19]

The UST curriculum included the space operations career field; mathematics; space sciences (physics, astronomy, orbital mechanics); spacecraft (design, ground support, manned and unmanned flights); surveillance, detection, and warning networks; applications (operating sensor and satellite simulators, performing crew scenarios); and future systems. In addition to scientific and technical subjects, the officers studied history, policy, law, doctrine, and systems acquisition as they related to space programs; they also toured space operations facilities at Cheyenne Mountain AFS and Falcon AFS in Colorado Springs.[20]

Program officials anticipated training about 200 officers annually, with classes of approximately 12 to 25 people each. The 18 UST instructors were experienced space operations officers, and they employed a team approach to teaching. Teams were organized into flights, with one flight of normally six instructors presenting all of the material to a particular class.[21]

In November 1986 Mr Mack F. Page, a training manager from the 3400 TCHTW's Space Systems Branch, made a staff assistance visit to the 3430 TCHTG. He complimented the personnel for their dedication to the space operations mission and for having developed and introduced UST by the October deadline. The case files for Instructional Systems Development and the Master Course handbook were noteworthy achievements; both were being properly

developed for the new program. Mr Page praised the management effort for the 27750 career development courses. In addition, he noted that the 3430th had identified those students in need of remedial work in mathematics and had introduced a critique program for gaining student views about UST.[22]

Selecting UST Applicants

UST provided the initial skills for officers entering the space operations career field. The program gave the Air Force "universally assignable" personnel to operate military sensor and space systems. After graduating from UST, officers assigned to AFSC reported directly to their first assignment for on-the-job training. The majority of those assigned to the USSPACECOM and AFSPACECOM reported to the 1013 CCTS at Peterson AFB for in-depth instruction on specific missions.[23]

A UST Selection Board met twice a year at HQ AFMPC to designate Air Force officers as candidates for the program. AFMPC notified the commanders of those people selected, and the commanders in turn informed their personnel. Applicants had seven days to respond to the Board's action, but anyone who declined an offer forfeited all future consideration for UST. In addition to the primary applicants, the Board chose alternates.[24]

UST was not limited to Air Force men and women. The course met training requirements for the Army, Navy, and Marine Corps, further enabling the United States to pursue an active mission in outer space. UST was open to officers from other branches of the armed forces serving with the USSPACECOM. The Commander of USSPACECOM regarded UST as the best way for his personnel to acquire a "common foundation" in space operations. The first joint service students entered training in August 1987, an Army lieutenant colonel and a Navy lieutenant. The program marked a milestone when these officers graduated in November.[25]

Organizational Changes

When the 3430 TCHTG began UST classes on 9 October 1986, HQ ATC officials were planning a reorganization of staff agencies to take effect on 1 April 1987. Realignment involved the Deputy Chiefs of Staff for Plans, Recruiting Service, Operations and Readiness, Logistics, and Technical Training. This action consolidated functions, centralized planning, and streamlined management of ATC's training programs.[26]

The realignment affected management of Lowry's undergraduate program. HQ ATC officials recognized that outer space would become an increasingly significant operational arena for the Air Force. This factor, coupled with similarities among the programs for pilots, navigators, and space operations officers, convinced the ATC Commander, Lt Gen John A. Shaud, to change the functional alignment for UST.[27]

General Shaud placed his three undergraduate programs on the same organizational level by transferring responsibility for UST from the technical training deputate to the operations deputate. The latter favored a separate space training squadron at Lowry that would not be part of the 3400 TCHTW but instead report directly to the center vice commander.[28]

HQ ATC activated the 3301 SCHS at Lowry on 1 July 1987, the initial step in the progression of UST from division to squadron status. The 3301st remained dependent upon the 3430 TCHTG for administrative support until 1 October 1987. Lt Col Ronald G. Forrester, Chief of the 3430th's UST Division since 1 December 1986, commanded the squadron. Completion of the shift to an independent unit occurred on 1 October 1987, when the 3301 SCHS was inactivated and succeeded by the 3301st Space Training Squadron (SPACETNGSQ).[29]

Inactivating Detachment 2. In January 1986 HQ ATC and HQ AFSPACECOM had established the Training Development Office at Peterson AFB to develop the UST curriculum, as already seen, and

the office became Detachment 2 of Lowry's 3430 TCHTG. Once UST began at Lowry and the validation phase was completed, the detachment personnel involved with course development would transfer to other Air Force duties while the remaining staff concentrated on the development and acquisition of training equipment. Although the responsibilities and tasks of the office would gradually shift to Lowry, this did not include manpower positions. On 15 December 1987, with the work of Detachment 2 now finished, HQ ATC inactivated the unit.[30]

Dedicating Building 408. LTTC's 3420 TCHTG conducted air intelligence training in Building 408. As part of the transfer of Air Force intelligence training to Goodfellow AFB in Texas, the group gradually relinquished space in Building 408 to the 3430 TCHTG, formerly located in Building 959. Joint occupancy started in July 1986, with full use by the 3430th planned for late in 1987, when the building would be dedicated.[31]

On 20 October 1987, General Shaud conducted the activation ceremony for the 3301 SPACETNGSQ and the assumption of command by Colonel Forrester. General Shaud also delivered the keynote address at the dedication of Building 408 as the Major Laurence L. Ballard Jr. Space Training Complex. A space operations officer with the 17th Surveillance Squadron, the Philippines, Major Ballard had died in a C-130 crash during a mission to Turkey in 1982.[32]

Major Ballard's space operations career encompassed positions as Deputy Missile Combat Crew Commander, Missile Combat Crew Commander, Missile Warning Crew Commander, and orbital analyst with the Space Surveillance Center at Cheyenne Mountain AFS. His other contributions to the career field included a guidebook on the Soviet space program and having played a key role in formation of the Space Surveillance Center.[33]

On 18 December 1987 Colonel Craigie, Commander of the 3430 TCHTG, signed a memorandum of agreement with Colonel Forrester governing joint use of Building 408. The 3301 SPACETNGSQ was

responsible for building security, assisted by the 3430th's security manager. The group occupied office, classroom, and laboratory facilities on the lower level; the 3301st had the upper level. The squadron's computer-based training system would be available to the 3430th as appropriate. Other provisions of the agreement concerned access to the building, security matters, custodial duties, and the UST library.[34]

NOTES - CHAPTER III

1. Levy intvw/Mr Charles L. Adams & Mr Mack F. Page, 3400 TCHTW/TTGXS, 9 Jul 86, hereinafter cited as Adams-Page intvw, 9 Jul 86; Levy intvw/Page, 18 Jul 86, hereinafter cited as Page intvw, 18 Jul 86; Rpt, DAF, "Air Force Plan for Space Operations Training," 15 Nov 85, p 1, hereinafter cited as USAF Sp Ops Tng Plan, 15 Nov 85; Rpt, "Self-Study Report of the 3400th Technical Training Wing," Lowry Technical Training Center, Jul 85, p III-3; Levy intvw/Mr Jerry Hensel, 3301 SPACETNGSQ/CCC, 16 Nov 89; Tlkg Ppr (Draft), 3400 TCHTW/TTGXS, subj: ATC/Space Command Training Interface, 7 Jun 85, hereinafter cited as Sp Tng Tlkg Ppr, 7 Jun 85; Page intvw, 30 Nov 89; Hickey ltr, 19 Jul 82; Ryan ltr, 19 Jul 82.

2. See note above.

3. Category I training encompassed basic skills and knowledge with general application throughout the Air Force. The major operating commands provided Category II specialized training, primarily for combat or combat support missions; USAF Sp Ops Tng Plan, 15 Nov 85, p 1.

4. See note 1.

5. Sp Tng Tlkg Ppr, 7 Jun 85; Page intvw, 18 Jul 86.

6. USAF Sp Ops Tng Plan, 15 Nov 85, passim; MFR, Mr Page, 3400 TCHTW/TTGXS, subj: Undergraduate Space Training (UST), 13 Feb 86, hereinafter cited as Page MFR, 13 Feb 86; Pt Ppr, Lt Col Ronald G. Forrester, 3430 TCHTG/TTMO, subj: Undergraduate Space Training, 8 Jun 87, hereinafter cited as Forrester pt ppr, 8 Jun 87; ATC CTS S-V95-A, Undergraduate Space Training, Jun 88, p 1.

7. USAF Sp Ops Tng Plan, 15 Nov 85, passim; Adams-Page intvw, 9 Jul 86; Page MFR, 13 Feb 86.

8. See note 1.

9. See note 1.

10. See note 1.

11. Memo & atchs, Lt Col Ronald R. Ackerman, 3400 TCHTG/TTGX, to Multiple Addressees, subj: [UST, Dec 85].

12. ATC SO G-46, 18 Nov 85; Ltr, Lt Col Donald F. Craigie, CC, Det 2, 3430 TCHTG, to 3430 TCHTG/CC, subj: Monthly Report, January 1986, 6 Feb 86; USAF Sp Ops Tng Plan, 15 Nov 85, Charter . . ., pp 1-2; Pt Ppr, Craigie, subj: Undergraduate Space Training (UST), Training Development Office (TDO), 2 Sep 86, hereinafter cited as Craigie pt ppr, 2 Sep 86.

13. Bullet Background Ppr, Col Charles L. Pike, AFSPACECOM/DOT, subj: Computer Based Training Systems (CBTS), Oct 86, hereinafter cited as Pike ppr, Oct 86; Ltr & atchs, Maj Curtis D. Converse, AFSPACECOM/DOTT, to Multiple Addressees, subj: Minutes of the CBTS Advisory Committee, 28 Oct 86, 3 Nov 86.

14. Pike ppr, Oct 86; Page intvw, 21 May 86.

15. Agreement to Align Space Operations Training Responsibilities Between Air Training Command (ATC) and Air Force Space Command (AFSPACECOM), May 86.

16. Ibid.

17. Ibid.

18. Tng Plan, G30BR2001 000 (PDS Code 8QE), Undergraduate Space Training, LTTC, 25 Aug 86, cover & p 1, hereinafter cited as UST Tng Plan, 25 Aug 86; SSS & atch, Lt Col Craigie, 3430 TCHTG/CC, to Maj Gen Joseph D. Moore, LTTC/CC, subj: Undergraduate Space Training, 30 Sep 86, hereinafter cited as Craigie SSS, 30 Sep 86.

19. Craigie SSS, 30 Sep 86; Levy intvw/Capt Kyle Moore, 3301 SPACETNGSQ/DOT, 19 May 89, hereinafter cited as Moore intvw, 19 May 89.

20. UST Tng Plan, 25 Aug 86, pp 1-2, 6-15 & 25; Pt Ppr, Lt Col Forrester, 3430 TCHTG/TTMO, subj: Undergraduate Space Training, 8 Jun 87; SSS & atchs, Col Craigie, 3430 TCHTG/CC, to Multiple Addressees, subj: Field Trips for Undergraduate Space Training (UST) Classes, 4 Feb 87.

21. Ltr & atchs, Col Theodore C. Dreyer, LTTC/CV, to ATC/DOP, subj: Baseline PDP for 3301st School Squadron (UST), 6 Aug 87; Moore intvw, 19 May 89.

22. SAV Rpt, Mr Page, 3400 TCHTG/TTGXS, [Nov 86]; Page intvw, 21 May 86.

23. Ltr & atchs, Maj Gen Larry N. Tibbetts, LTTC/CC, to Lt Gen John A. Shaud, ATC/CC, subj: [UST "how goes it" report], 18 Nov 87, hereinafter cited as Tibbetts ltr, 18 Nov 87; Ltr & atch, Gen Robert T. Herres, USSPACECOM/CC, to Rear Adm Jimmie W. Taylor, USN, Sect, ITRO, Ch/Naval Ed & Tng, NAS Pensacola, FL, subj: USSPACECOM Training Policy, 16 Jan 87, hereinafter cited as Herres ltr, 16 Jan 87.

24. ATC/TT & DO, Transfer Plan for the Undergraduate Space Training (UST) Program, 1 Apr 87, Sec H, hereinafter cited as UST Trans Plan, 1 Apr 87; Msg (FOUO), HQ AFMPC to Multiple Addressees, subj: December 1986 USAF Undergraduate Space Training (UST) Selection Board Results, 052105Z Jan 87 (material used is not FOUO); Msg, HQ AFMPC to Multiple Addressees, subj: Undergraduate Space Training (UST) Selection Board, 062105Z Feb 87.

25. Tibbetts ltr, 18 Nov 87; AFSPACECOM, Statement of Operational Need (SON) 01-87 (Format C) for the Joint Air Training Command/ Air Force Space Command Undergraduate Space Training (UST)

Program, 13 Feb 87, pp 1 & 3; UST Trans Plan, 1 Apr 87, Introduction; Herres ltr, 16 Jan 87.

26. SSS & atch, Brig Gen Robert S. Delligatti, ATC/XP, to Multiple Addressees, subj: HQ ATC Reorganization, 3 Apr 87.

27. SSS & atchs, Col William F. Phillips, ATC/DO, to Multiple Addressees, subj: UST Chain of Command/Internal Structure, [May 87]; Levy intvws/Mr Samuel Bouknight, 3430 TCHTG/TTOT, 8 Mar 88, & Capt Kyle Moore, 3301 SPACETNGSQ/DOT, 10 Mar 88.

28. See note above; Ltr, Col Jeffrey T. Ellis, ATC/DO, to 3430 TCHTG/TTMO, subj: Undergraduate Space Training (UST), 5 May 1987.

29. ATC SOs: G-117, 1 Jul 87, G-221, 13 Jul 87, G-138, 1 Sep 87; Ltr, Lt Col Forrester, 3301 SPACETNGSQ/CC, to 3415 ABG/DAA, subj: Office Symbols for 3301st Space Training Squadron, 23 Sep 87; Col Phillips, ATC/DO, & Maj Gen William J. Grove, ATC/TT, Undergraduate Space Training (UST) Working Group Transfer Plan, 16 Jun 87; Ltr & atchs, Col Dreyer, LTTC/CV, to 3415 ABG/DA, subj: Request for Publication of G-Series Orders, 1 Oct 87.

30. Craigie pt ppr, 2 Sep 86; Memo, Col Willard Grosvenor, 3430 TCHTG/CC, to Col Murle A. Wilson, 3400 TCHTW/CC, subj: Training Development Office (TDO) "Future," 29 Aug 86; ATC SO G-20, 4 Dec 87.

31. For background information on Building 408, see 1985 LTTC Hist, I (PV), pp 43 & 45 (material used is not PV), & 1986 LTTC Hist, I (PV), pp 53-54 (material used is not PV).

32. SSS & atchs, Lt Col Forrester, 3301 SCHS/CC, to LTTC/CC, subj: Building Dedication, 3 Sep 87, hereinafter cited as Forrester SSS, 3 Sep 87; see also, "Building dedicated to space pioneer," Lowry Airmen, 30 Oct 87, p 6.

33. Forrester SSS, 3 Sep 87.

34. Col Craigie, 3430 TCHTG/CC, & Lt Col Forrester, 3301 SPACETNGSQ/CC, Memorandum of Agreement (MOA) between 3430th Technical Training Group (TCHTG) and 3301st Space Training Squadron (SPACETNGSQ), 18 Dec 87.

The celestial sphere is used to teach UST students about the space environment. (Base Photo Lab, Dec 1989)

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CHAPTER IV

REVISING UNDERGRADUATE SPACE TRAINING

Introduction

The first UST class of 25 officers graduated at Lowry on 20 February 1987. Secretary of the Air Force Edward C. Aldridge gave the keynote address during ceremonies at the base theater. He told the graduates that space operations represented a major Air Force career field, and one that would grow in importance to national defense.[1] The graduates received the Air Force Space Badge on a temporary basis; by demonstrating proficiency in their jobs, they could apply for permanent award.[2]

The Air Force conducted the initial UST classes while the course was still in the development stage. HQ ATC established a validation phase encompassing seven classes, beginning with the start of training for the first class on 9 October 1986 and lasting through graduation of the seventh class on 23 October 1987. Members of the 3301 SPACETNGSQ worked with officials from HQ AFSPACECOM, HQ AFSC, and HQ ATC to revise the course.[3]

The UST Validation Phase

The 3301 SPACETNGSQ conducted the UST evaluation and declared the program a success. In developing UST, program managers decided that all students would receive the same level of training regardless of their Air Force background and academic education. A standard for mathematics, however (a minimum of six semester hours of college mathematics, including three hours of calculus), was not incorporated into AFR 36-1, Officer

Classification, until 1 April 1987. Not all UST students met this requirement, and several needed remedial assistance in mathematics as well as physics.[4]

There were some curriculum problems. The evolving nature of the space operations career field had two effects: there was conflicting information in the textual sources, and lesson plans and audiovisual material had to be updated during the course. Also, the faculty's fragmentary knowledge of UST development and the overall course contributed to redundancy in some lessons.[5]

Testing was another concern. UST adopted standardized testing geared to the students completing lessons by a certain time, but the classes advanced at different rates. Weekly progress checks tested students on material that had not always been covered in class, and biweekly written tests included material from the progress checks. To remedy these problems, the squadron eliminated the progress checks and administered written tests after each lesson unit.[6]

Students also complained about the length of the academic day (eight hours daily, five times a week) and instruction that was limited to lectures. The staff anticipated improvements in this area with the introduction of computers and hands-on training. In 1987, LTTC made progress in getting computer hardware and software for the course.[7]

Lowry graduated 9 UST classes and 204 officers in 1987. Each graduate received ATC Form 2001, Certificate of Space Operations Training, and nonpermanent award of the Space Badge, plus qualification for further training in the career field. New space operations officers were assigned to the following career areas: satellite operations, sensor operations, manned spaceflight, orbital analyst/command center duties, and staff positions. The many general officers from HQ AFSPACECOM and HQ USAF appearing as guest speakers at the graduation ceremonies was indicative of the level of Air Force support for UST.[8]

Refining the UST Curriculum

A course training standard review held at Lowry in March 1988 recommended changes for improving the presentation of material; for example, reducing the number of hours from 578 to 472, and the number of academic days from 82 to 72. The 3301 SPACETNGSQ rewrote both the Course Training Standard listing the required knowledge and skills needed by graduates and the Syllabus of Instruction. HQ ATC and HQ AFSPACECOM approved these measures, and ATC published both documents in June 1988. The squadron divided UST into 13 units: Mechanics and Physical Sciences (mechanics, electricity and magnetism, thermodynamics, optics); Space Sciences (space environment, orbital mechanics); Space Program Overview (history of space programs; organizations; policy, doctrine, and laws; systems acquisitions process); Information Management Systems (computers, space systems communications); Spaceflight Fundamentals (aerodynamics, structural design, rocket design, US launch systems, spacecraft subsystems); Spaceflight Operations (Air Force satellite control network, satellite systems and survivability, national space transportation system); Surveillance, Detection, and Warning (sensor fundamentals, sensor operations, command center operations, sensor operations exercise); Foreign Systems; Part-Task Training (generic space operator skills); Crew Scenarios; Processing and Orientation; Security Education; and Career Field and Professional Development.[9]

The academic standard for passing each UST unit of instruction was 85 percent. A Special Monitoring Status program tracked those students having problems meeting the standards for academic or military performance, helped them overcome their deficiencies, and determined which students could not successfully complete the course. In addition to academics, UST provided physical training to ensure that the students met service requirements for weight and physical fitness.[10]

The 3301 SPACETNGSQ tested all entering students in mathematics skills for possible Special Monitoring Status. For

assistance with the mathematics work required for the course, students were encouraged to use the lessons available in the squadron's Math Computer-Aided Instruction Laboratory after the regular training hours. In addition, the students could request help from their instructors.[11]

At the time of the March 1988 conference, UST included a review of basic mathematics. Many of the students, however, had engineering backgrounds and found this work to be unnecessary. HQ AFSPACECOM officials agreed with a proposal for deleting the review to save money and to reduce the length of the course, as already noted above. The 3301 SPACETNGSQ revised some units of instruction (for example, orbital mechanics and mechanics) to incorporate mathematics skills, and students could use the Math Computer-Aided Instruction Laboratory.[12]

In devising the curriculum, ATC and AFSPACECOM officials wanted to use computers in presenting material to the students. The training methodology combined the means of instruction with management and administrative functions. The instructional equipment included computers, part-task trainers (training devices simulating one function or part of a system), and simulation techniques. With the addition of simulators, the students would perform tasks comparable to duties with Air Force field units.[13]

Computer-aided instruction (CAI) used computers to present information. The computer questioned each student about the material, simulated real-world tasks (for example, operating an aircraft or other piece of equipment), and provided the student with an opportunity to experiment with new situations. Computer-managed instruction (CMI) used computers to accomplish management and administrative functions; for example, tracking student test scores, assigning lessons, and monitoring progress in learning the material being presented. The local area network (LAN), the physical connection between the components of a computer system, enabled the users to communicate and share information.[14]

A lack of computer-based instruction for the initial classes limited UST to academics only in 1987 and 1988, but officials at HQ ATC knew that combining academic and computerized training was a prerequisite for a successful program. The students needed computer support to develop the motor skills and degrees of awareness for mastering performance-oriented tasks. The 3301 SPACETNGSQ identified other areas requiring computer support: to aid students in understanding classroom topics; to provide remedial training; to record information about the students and transmit this data to HQ ATC and HQ AFSPACECOM; and to prepare graphics in a timely manner.[15]

The Air Force began acquiring training equipment for UST in 1987. The 3301 SPACETNGSQ received 40 AT&T PC 6300 computer workstations, 4 AT&T 382-400 minicomputers, 20 printers (IBM, Alp, and Genicom), and a Zenith Z-248 computer for administrative matters and course development. Because UST funding was not part of the FY 1988-1992 Program Objective Memorandum, HQ AFSPACECOM purchased the equipment and funded the courseware and simulator development. The squadron made no computer purchases in 1988, but anticipated acquiring 30 personal computers, 3 printers, and 1 optical scanner in 1989, all for the generic satellite model (GSM).[16]

United Airlines Services Corporation developed the software for CAI and delivered ten hours of mathematics lessons in 1987 and again in 1988. The squadron began acceptance and performance testing with the software. To assist with the acquisition of equipment for CAI, HQ ATC on 1 April 1988 activated OL-A of the 3301 SPACETNGSQ at Peterson AFB, but defining what HQ AFSPACECOM wanted in the way of hands-on training (individual part-task training and crew scenarios) delayed the addition of this important phase of UST in 1988.[17]

In May 1988, the 3301 SPACETNGSQ and the Operations Systems Division of the Deputy Chief of Staff for Operations and Readiness at HQ ATC finished reviewing the requirements for a computerized training system. There were three problems with the

existing arrangement: excessive screen flicker gave the students headaches; the minicomputers for the Tutor-Accord authoring system (for developing CAI and data collection for CMI) had a slow response time (20 seconds); and becoming proficient with Tutor-Accord required one year. Therefore, the squadron terminated the United contract; directed its Courseware Branch to develop the remaining mathematics lessons; and replaced Tutor-Accord with the Authology system, which could be learned in two weeks.[18]

Another change resulting from the validation review and the student critiques involved the method of teaching. UST officials recognized the importance of having instructors with both technical and operational experience. The 3301 SPACETNGSQ evaluated new instructors within their first 90 days, and the others annually. As a further quality check, instructors were selected at random for evaluation during unit inspections, and the squadron held no-notice evaluations.[19]

The team approach to teaching had drawbacks: some instructors lacked the essential engineering and technical training for the UST curriculum; faculty turnover compromised the principle of having classes taught by the same instructors; and the faculty turnover also resulted in a shortage of qualified instructors for certain lessons.[20]

In July 1988, the 3301 SPACETNGSQ adopted an "expert" system that was beneficial to the students and the instructors. Those instructors with expertise in a particular area taught that unit to each UST class. For the students, the instructors presented material in a more uniform manner. The new method lowered the teaching load and the amount of subject matter instructors were required to know. As a result, the squadron was able to reduce the number of instructor flights from three to two and assign four instructors to curriculum development.[21]

As part of the continuing effort to improve UST, the 3301 SPACETNGSQ was developing a GSM to familiarize students with

basic satellite operations in a crew setting. Students would receive and process data in the areas of missile warning, command and control, space surveillance, and satellite operations. By the end of 1988, the squadron had prepared a functional specification document and was evaluating hardware requirements for 15 student terminals (plus an additional 5 for supporting computer-aided instruction) and 5 instructor terminals.[22]

The Air Force responded to Congress' refusal to appropriate funds for a proposed Space Operations Planning Center by reducing the number of officers projected for entry into the space operations career field. The number of students attending UST dropped in 1988, and the 3301 SPACETNGSQ graduated only 86 officers (including 9 Army officers) in 9 classes, compared with 204 graduates in 1987. Because of an overage in the career field at the Johnson Space Center, however, Air Force space operations were not affected by the lower number of UST graduates in 1988.[23]

Three classes in 1988 had four members each, the smallest number to date. Class 89-01, graduating on 4 November 1988 with 12 students, was the first class comprised solely of second lieutenants. In 1988, the squadron eliminated six students from training: four failed to meet the academic prerequisites; one cheated on an examination; and one was dropped for being overweight.[24]

NOTES - CHAPTER IV

1. "UST graduates head for high frontier," Lowry Airmen, 27 Feb 87, pp 1 & 3.

2. Msg, HQ USAF to 3400 TCHTW/CC, subj: Waiver to AFR 35-30 Temporary Award of Space Badge to UST Graduates, 052234Z Feb 87; Levy intvw/Capt Kyle Moore, 3301 SPACETNGSQ/DOT, 24 May 88.

3. Rpt, [3301 SPACETNGSQ], "Undergraduate Space Training (UST) Validation Review Summary," [c. Nov 87], Sec 2, hereinafter cited as UST Validation Sum.

4. UST Validation Sum, Sec 2.

5. Ibid.

6. Ibid.

7. Ibid.

8. Ltr & atchs, Maj Gen Tibbetts, LTTC/CC, to Lt Gen Shaud, ATC/CC, subj: [UST "how goes it" report], 18 Nov 87, hereinafter cited as Tibbetts ltr, 18 Nov 87; UST Syllabus S-V95-A, Syllabus of Instruction for Undergraduate Space Training, Jun 88, p 1, hereinafter cited as UST Syllabus, Jun 88.

9. Levy intvw/Capt Moore, 3301 SPACETNGSQ/DOT, 19 May 89, hereinafter cited as Moore intvw, 19 May 89; UST Syllabus, Jun 88, pp 2 & 9-17; ATC CTS S-V95-A, Undergraduate Space Training, Jun 88, p 1, hereinafter cited as ATC CTS S-V95, Jun 88.

10. ATC Syllabus S-V95-A, Syllabus of Instruction for Undergraduate Space Training, Jul 89, pp 3 & 6, hereinafter cited as UST Syllabus S-V95-A, Jul 89; ATC CTS S-V95-A, Undergraduate Space Training, Jul 89, p 1, hereinafter cited as UST CTS S-V95-A, Jul 89.

11. Levy intvw/Capt Moore, 31 Jan 90.

12. Moore intvw, 19 May 89; Rpt, 3301 SPACETNGSQ, "Functional Description of Undergraduate Space Training Computer Requirements," 19 May 88, p 8, hereinafter cited as UST Functional Description.

13. UST Validation Sum, Sec 2; Levy intvw/Mr Brian E. Dallman, 3400 TCHTW/TTOZ, 26 Oct 89, hereinafter cited as Dallman intvw, 26 Oct 89.

14. Dallman intvw, 26 Oct 89.

15. UST Functional Description, pp 4-6.

16. Tibbetts ltr, 18 Nov 87; Moore intvws, 10 Mar 88 & 19 May 89; UST Syllabus, Jun 88, p 3.

17. See note above; Ltr & atchs, Lt Col Forrester, 3301 SPACETNGSQ/CC, to Multiple Addressees, subj: Minutes of the Eighth UST Status Review, 6 Sep 88, hereinafter cited as Forrester ltr, 6 Sep 88; ATC SO G-42, 1 Apr 88.

18. UST Functional Description, passim; Moore intvw, 19 May 89; Forrester ltr, 6 Sep 88; Ltr & atch, Lt Col Forrester to 3430 TCHTG/CC & 3400 TCHTW/TTGXR, subj: Justification for Undergraduate Space Training (UST) Equipment, 17 Feb 87; Levy intvw/Capt William Day, 3301 SPACETNGSQ/CC, 29 Nov 89.

19. Moore intvw, 19 May 89; UST Validation Sum, Sec 2; Forrester ltr, 6 Sep 88.

20. See note above.

21. Moore intvw, 19 May 89; Forrester ltr, 6 Sep 88.

22. Moore intvw, 19 May 89; Rpt, 3301 SPACETNGSQ, "Functional Specification for the Undergraduate Space Training Generic Satellite Model," 13 Dec 88, pp 1-8.

23. Moore intvw, 19 May 89; Levy intvw/Maj James T. Burton, 3301 SPACETNGSQ/CCO, 29 Nov 89; ATC Form 471, Graduation Rosters: Class 88-05, 11 Mar 88; Class 88-06, 8 Apr 88; Class 88-07, 13 May 88; Class 88-08, 17 Jun 88; Class 88-09, 22 Jul 88; Class 88-10, 23 Sep 88; Class 89-01, 4 Nov 88; and 89-02, 16 Dec 88.

24. ATC Form 471, Graduation Rosters: Class 88-05, 11 Mar 88; Class 88-06, 8 Apr 88; Class 88-07, 13 May 88; Class 88-08, 17 Jun 88; Class 88-09, 22 Jul 88; Class 88-10, 23 Sep 88; Class 89-01, 4 Nov 88; and 89-02, 16 Dec 88.

CHAPTER V

UNDERGRADUATE SPACE TRAINING: MOVING FORWARD

Introduction

UST prepared Air Force officers entering the 20XX space operations career field, as well as small numbers of officers from the Army and Navy. The program helped the USAF pursue an active military role in outer space. In the first half of 1989, 66 officers in 5 classes graduated from UST. This contrasted with 86 graduates in 1988, reflecting the increased training requirements levied by HQ USSPACECOM and HQ AFSPACECOM.[1]

The 3301 SPACETNGSQ was organized into four branches. The Curriculum Branch developed and implemented the academic and computer-based training programs. This involved changes to the Course Training Standard and Syllabus of Instruction, and preparation of course materials. The Resource/Administration Branch was responsible for squadron resources (financial, documentation, correspondence) and managed the UST Library. The Standardization/Evaluation Branch managed the self-inspection program and determined whether squadron and HQ ATC regulations (51 series) were being followed. The Operations Training Branch supervised UST and evaluated student performance.[2]

As of 30 June 1989, the 3301st had a manpower strength of 37 authorized (25 officers, 8 enlisted, and 4 civilians) and 36 assigned (23 officers, 9 enlisted, and 4 civilians). Later in the year, the squadron was scheduled to receive additional officers: two computer programmers for the GSM, and one programmer for computer-based training. (With HQ ATC's inactivation of OL-A at Peterson AFB on 1 February 1989, the

3301st gained three 4925 computer programmer authorizations.) The squadron had a FY 1989 budget of $76,200.[3]

UST had a one-hour Library Orientation unit that consisted of a tour of the library and a briefing on its policies and procedures. The facility maintained material needed for research and study, and also contained safes for storing classified documents. Most units of instruction required the students to work in the library.[4]

In 1989, the squadron library increased its research capabilities in the areas of catalogue search, technical books and periodicals, NASA technical publications, and videos; the facility also acquired a microfiche reader/printer. As of 30 June, the library collection numbered approximately 300 books and 350 videos, and more books and videos were on order. To improve the study area, the squadron planned to increase the number of sofas, chairs, and tables. The library could also be used by AFSPACECOM personnel.[5]

Program Changes

The instructor and the student both played key roles in determining whether UST was satisfying AFSPACECOM requirements and if any instructional units needed to be revised. The instructors maintained a daily time log for each unit. Formal critiques provided the student viewpoint. Squadron personnel used these inputs when amending the Course Training Standard and Syllabus of Instruction.[6]

Once a year, the 3301 SPACETNGSQ hosted a conference to examine the training standards and the syllabus. At the second UST Course Training Standards and Syllabus Review on 14-15 March 1989, squadron members and personnel from HQ AFSPACECOM and HQ ATC agreed that UST could be shortened from 72 days and 472 hours, to 69 days and 452 hours. The number of units were reduced from 37 to 35 (Structural Design and Sensor Operations

Exercise were dropped), and there were increases or decreases in the hours for some of them. Major reductions occurred in two units: Mechanics (from 45 hours to 32 hours) and Rocket Design (from 25 hours to 11 hours). These changes became effective with Class 90-02, which began on 3 August 1989 (see Table V-1).[7]

TABLE V-1

UNDERGRADUATE SPACE TRAINING

UNIT TITLE	HOURS
Mechanics	32
Thermodynamics	12
Electricity & Magnetism	30
Optics	18
Space Environment	12
Orbital Mechanics	48
History (space programs)	22
Organizations	9
Policy, Doctrine & Law	10
Acquisition (systems process)	16
Computers	5
Communications (space systems)	9
Aerodynamics	10
Rocket Design	11
Spacecraft Subsystems	13
Satellite Operations	11
Sat Systems & Survivability	11
US Launch Systems	15
Manned Spaceflight	4
Sensor Fundamentals	12
Sensor Operations	18
Command Center Operations	15
Foreign Systems	21
Welcome and Processing	4
Library Orientation	1
Math Pre-Test	3

TABLE V-1 (contd)

Administrative Actions	17
End of Course Critique	1
Security	9
Career Field Information	3
Orientation Visits	16
Staff Comunications Skills	13
Officer Quality Enhancement	5
Guest Speakers	12
Commander's Option	4
TOTAL	452
COURSE LENGTH (DAYS)	69
HOURS PER DAY	6.6

SOURCE: TDY Rpt & atchs, Maj David P. Kunkel, ATC/DOPA, to Multiple Addressees, subj: UST CTS & Syllabus Review; Pre-SOCMG Meetings, 20 Mar 89; & ATC Syllabus S-V95-A, Syllabus of Instruction for Undergraduate Space Training, Jul 89, pp 9-17.

The squadron advanced in the areas of CMI and CAI. In 1988, as noted above, squadron personnel began replacing the Tutor-Accord system for developing CAI and data collection for CMI with Authology.[8] The new "user friendly" program ran well on the AT&T computers. Converting the former contractor-developed 20 hours of Tutor-Accord mathematics lessons to Authology was completed on 30 June 1989. The Authology program was also instrumental in designing lessons for the Processing and Orientation, Aerodynamics, and Orbital Mechanics units.[9]

UST required a LAN to support CMI, and the personal computer boards were ordered on 13 March 1989. The LAN software, however, was being revised by the contractor (American Telephone and Telegraph), with delivery expected late in 1989. The squadron acquired the CMI User Manuals in December 1988 and tested the 7101 Autodin Transmittal software the following month. In April

1989, the Data Base Administrator received training on the Unix computer operating system software.[10]

Analogous to a brain, the operating system enabled the computer network to function by controlling the central processing unit and providing access to the data. The system permitted the user to run several programs simultaneously and performed such basic tasks as storing and retrieving information and displaying files. A unique aspect of the Unix operating system was its capability for running all of the classes of computer systems, from personal computers and mainframes to supercomputers.[11]

For CAI, the squadron gained a staff sergeant (75171) on 1 December 1988 as the Unit Training Manager, and that person attended the Instructional Systems Development course at Sheppard AFB, Texas, in March and April 1989. On 12 June, squadron personnel tested the Lesson Presenter software; the hardware keys were defective and had to be returned for replacement. In July, an officer (49172) joined the squadron as a programmer for computer-based training.[12]

Work continued on the GSM, which was necessary for satisfying the part-task training requirements listed in the UST Course Training Standard. Divided into three-man crews, students would receive verbal and written inputs, monitor and maintain satellite conditions using checklists, mission profiles, and Missile Warning/Satellite Control Facility scenarios. HQ AFSPACECOM allocated $300,000 for purchasing GSM equipment. The squadron received 2 AT&T PC6386 computers on 24 February 1989 and 26 computers on 7 June. When the two computer programmer officers reported for duty in July, work began on the GSM design phase. Other GSM equipment arrived in 1989: 28 AT&T video monitors on 1 August, a Panasonic RS-506 scanner on 10 August, and three Epson FX 1050 printers on 30 October. With the acquisition of this GSM equipment, by the end of 1989 UST was well on the way to becoming a mature program of instruction for the Air Force.[13]

Looking Ahead: Undergraduate Space Training for the 1990s

On 24 May 1989, Lt Col Joseph D. Dumoulin assumed command of the 3301 SPACETNGSQ from Colonel Ronald G. Forrester. Colonel Dumoulin had an extensive space operations background that qualified him for bringing UST to full development. He came to Lowry from the Air Force's 19th Surveillance Squadron in Turkey, and he had been assigned to AFSPACECOM and was a co-author of Air University's "Space Handbook" (AU-18). The new commander had three major goals for achieving UST maturity: providing "hands-on" training through the GSM, improving the academics portion of the course, and introducing the UST Space Operations Staff Officer Course.[14]

HQ AFSPACECOM officials expressed satisfaction with the existing UST program, but they knew that "hands-on" training (individual part-task training and crew scenarios providing students with generic space operator skills necessary for continuing training) would enhance the academic instruction. This addition to the course with the computer-based GSM was scheduled to begin in May 1990 for the missile warning and air breathing modules, followed thereafter by training for the space surveillance and satellite operation functions. This important part of UST would take place in a simulated crew environment. Colonel Dumoulin expected to have the GSM completely ready for "hands-on" training early in 1991.[15]

UST was meeting HQ AFSPACECOM requirements, but squadron personnel anticipated further improvement in the academics instruction. They planned to accomplish this with video shows (state-of-the-art graphics presentations and using computers to display material); a series of seminars, discussions, debates, and guest speakers to present information; and a unique design integration exercise.[16]

The design integration exercise would be added to the program in 1990. Colonel Dumoulin looked upon the exercise as a way of tying together the blocks of instruction (35) comprising

UST. Scheduled toward the end of the course, the unclassified exercise enabled two to four students, performing as a team, to combine the separate elements of their training in solving an operational problem. They had to think critically, make judgments, and use intuitive reasoning. The initial exercise involved a Commander in Chief, Pacific (CINCPAC) scenario, but Colonel Dumoulin expected the exercise to be expanded to other military commands.[17]

The CINCPAC scenario supported a Marine Corps amphibious raid against an island in the Pacific Ocean, and the requirement was for satellite surveillance of the island (the beach, foliage, water depth, disposition of forces, and order of battle) for a specified period of time. The students prepared a solution to the problem; however, there was no "right" solution. Working together, they had to design a satellite (including subsystems and onboard sensors) for the surveillance mission; launch the satellite; and maneuver and defend it from a ground-based laser threat.[18]

HQ AFSPACECOM officials wanted ATC to conduct a course for field grade officers that was similar to UST but shorter (without the scientific units). With the basic UST course being taught at Lowry AFB, the March 1989 UST Course Training Standards and Syllabus Review examined a proposal for having the 3301st develop and introduce the new course. The Space Operations Staff Officer Course would train these individuals for duty in the space operations career field. As proposed, the course consisted of 188 hours and 23 days, with 25 instructional units (see Table V-2). It offered basic space operations knowledge and skills, as well as officer development training. The minimum academic passing grade was 85 percent.[19]

The Air Force planned to train 30 to 40 people annually in the Space Operations Staff Officer Course. The graduates would receive Air Force Form 1256, Certificate of Training, but they had to serve in a space operations staff officer position (2011 or 2091) one year before applying for award of the space badge.

TABLE V-2

SPACE OPERATIONS STAFF OFFICER COURSE

UNIT TITLE	HOURS
Space Environment	5
Orbital Mechanics	16
History	8
Organizations	3
Policy, Doctrine & Law	8
Acquisition	4
Rocket Design	3
Spacecraft Subsystems	13
Communications	6
Satellite Operations	11
Sat Systems & Survivability	11
U.S. Launch Systems	10
Manned Spaceflight	4
Sensor Fundamentals	10
Sensor Operations	16
Command Center Operations	10
Concept of Operations	4
Foreign Systems	17
Welcome and Processing	3
Administrative Actions	4
Examinations	6
End-of-Course Critique	1
Career Field Information	2
Orientation Visits	12
Commander's Option	1
TOTAL	188
COURSE LENGTH (DAYS)	23
HOURS PER DAY	8.0

SOURCE: ATC Syllabus S-V95-B, Syllabus of Instruction for Space Operations Staff Officer Course (SOSOC), Sep 89, pp 1-2 & 8-14.

The first class was scheduled to start in February 1990. The course differed from another ATC program to give military staff officers serving in non-operator positions a general knowledge of space operations. The Joint Space Fundamentals Course was shorter and covered fewer units of instruction (136 hours, 17 days).[20]

By 1991, Colonel Dumoulin anticipated that the 3301 SPACETNGSQ will have achieved his goals for transforming UST into a "mature" ATC course. With the exception of minor refinements, the commander envisioned no major changes to UST for some time thereafter.[21]

NOTES - CHAPTER V

1. ATC Syllabus S-V95-A, Syllabus of Instruction for Undergraduate Space Training, Jul 89, pp 3 & 6, hereinafter cited as UST Syllabus S-V95-A, Jul 89; ATC CTS S-V95-A, Undergraduate Space Training, Jul 89, p 1, hereinafter cited as UST CTS S-V95-A, Jul 89; ATC Form 471A, Graduation Rosters: Class 89-03, 10 Feb 89; Class 89-04, 17 Mar 89; Class 89-05, 21 Apr 89; Class 89-06, 26 May 89; Class 89-07, 30 Jun 89; Levy intvw/Mr Jerry Hensel, 3301 SPACETNGSQ/CCC, 16 Nov 89, hereinafter cited as Hensel intvw, 16 Nov 89.

2. Hensel intvw, 16 Nov 89.

3. LTTC Staff Directory, Aug 89; Ltr & atchs, Maj James T. Burton, 3301 SPACETNGSQ/CCO, to Multiple Addressees, subj: Minutes of the Status Review Board, 27 Jun 89, hereinafter cited as Burton ltr, 27 Jun 89; HQ ATC SO G-11, 17 Jan 89.

4. Hensel intvw, 31 Jan 90; UST Syllabus S-V95-A, Jul 89, p 16.

5. Hensel intvw, 16 Nov 89.

6. TDY Rpt & atchs, Maj David P. Kunkel, ATC/DOPA, to Multiple Addressees, subj: UST CTS & Syllabus Review; Pre-SOCMG Meetings, 20 Mar 89, hereinafter cited as Kunkel TDY rpt, 20 Mar 89; Ltr & atchs, Col Forrester, 3301 SPACETNGSQ/CC, to Multiple Addressees, subj: Minutes of the Status Review Board, 15 May 89, hereinafter cited as Forrester ltr, 15 May 89; Burton ltr, 27 Jun 89.

7. Kunkel TDY rpt, 20 Mar 89; UST Syllabus S-V95-A, Jul 89, pp 9-17; Hensel intvw, 16 Nov 89.

8. For more information on the change in authoring systems, see pp 37-38.

9. Forrester ltr, 15 May 89; Burton ltr, 27 Jun 89; Rpt (PV), "Unit Effectiveness and Operational Readiness Inspection Report, Lowry Technical Training Center, 10 - 22 Sep 89," Tab E-1.3 (material used is not PV).

10. Forrester ltr, 15 May 89; Burton ltr, 27 Jun 89.

11. Levy intvw/TSgt William South, 3400 TCHTW/TTGX, 1 May 89; John Markoff, "A.T.&T.-Sun Near End of a Key Software Race," The New York Times, 25 Oct 89, p C1.

12. Forrester ltr, 15 May 89; Burton ltr, 27 Jun 89.

13. See note above; Hensel intvw, 16 Nov 89.

14. "Space training squadron gets new commander," Lowry Airman, 26 May 89, p 2; Levy intvw/Lt Col Joseph D. Dumoulin, 3301 SPACETNGSQ/CC, 7 Nov 89, hereinafter cited as Dumoulin intvw, 7 Nov 89.

15. Dumoulin intvw, 7 Nov 89; UST Syllabus S-V95-A, Jul 89, p 3; ATC CTS S-V95-A, Jul 89, p 4.

16. HQ ATC lacked a formal feedback system for analyzing the effectiveness of UST, relying on verbal information from HQ AFSPACECOM; Dumoulin intvw, 7 Nov 89.

17. Dumoulin intvw, 7 Nov 89; Hensel intvw, 16 Nov 89.

18. See note above.

19. See note 16; Kunkel TDY rpt, 20 Mar 89; ATC Syllabus S-V95-B, Syllabus of Instruction for Space Operations Staff Officer Course (SOSOC), Sep 89, pp 1-2 & 7-14, hereinafter cited as SOSOC Syllabus S-V95-B, Sep 89.

20. SOSOC Syllabus S-V95-B, Sep 89, pp 1 & 7; Kunkel TDY rpt, 20 Mar 89; Burton ltr, 27 Jun 89; Dumoulin intvw, 7 Nov 89; Hensel

intvw, 16 Nov 89; for further information on the Joint Space Fundamentals Course, see 1988 LTTC Hist, I (PV), pp 86-89.

21. Dumoulin intvw, 7 Nov 89.

APPENDIX A

SPACE OPERATIONS ORGANIZATIONS AT LOWRY AFB

UNIT	ACTIVATED	INACTIVATED
Det 1, 3414th Instructor Sq, KTTC	1 Mar 1972	1 Sep 1973
3447 SCHS*	1 Sep 1973	30 Apr 1976
3422 SCHS**	30 Apr 1976	1 Apr 1977
3422 TCHTS***	1 Apr 1977	1 Oct 1982
3422 SCHS***	1 Oct 1982	31 Mar 1985
Det 1, Peterson AFB	1 Jul 1983	1 Jul 1984
3430 TCHTG#	1 Oct 1984	
3423 TCHTS, Peterson AFB##	1 Jul 1984	
Det 2, Peterson AFB	1 Jan 1986	15 Dec 1987
3301 SCHS	1 Jul 1987	1 Oct 1987
3301 SPACETNGSQ	1 Oct 1987	

*Assigned to HQ USAF School of Applied Aerospace Sciences, Lowry.

**Assigned to 3420 TCHTG, USAF School of Applied Aerospace Sciences, Lowry.

***Assigned to HQ 3400 TCHTW. On 1 April 1977, HQ ATC inactivated the USAF Schools of Applied Aerospace Sciences at its technical training centers and replaced them with numbered technical training wings.

#The group's UST Division provided UST. Since 1 April 1987, ATC's Deputy Chief of Staff for Operations and Readiness, not the Deputy Chief of Staff for Technical Training, has exercised management responsibility for UST. Thereafter, the chief of the UST Division, and later the commanders of the 3301 SCHS and 3301 SPACETNGSQ, reported to the LTTC vice commander.

##Prior to formation of the 3430 TCHTG, the 3423 TCHTS reported to the commander of the 3400 TCHTW.

GLOSSARY

A

AFB	Air Force Base
AFMPC	Air Force Manpower and Personnel Center; later, Air Force Military Personnel Center
AFS	Air Force Station
AFSC	Air Force Systems Command, Air Force Specialty Code
AFSPACECOM	Air Force Space Command
ATC	Air Training Command
ATCH	Attachment

B

BRFG	Briefing
BRIG	Brigadier

C

C	Circa, About
CAI	Computer-Aided Instruction
CC	Commander
CCTS	Combat Crew Training Squadron
CH	Chief
CINCPAC	Commander in Chief, Pacific
CMI	Computer-Managed Instruction
CSOC	Consolidated Space Operations Center
CTS	Course Training Standard
CV	Vice Commander

D

DAF	Department of the Air Force
DCS	Deputy Chief of Staff
DET	Detachment
DMSP	Defense Meteorological Satellite Program
DO	Deputy Chief of Staff for Operations and Readiness
DOD	Department of Defense
DSP	Defense Support Program

F

FOUO	For Official Use Only
FY	Fiscal Year

G

GEN	General
GPS	Global Positioning System
GSM	Generic Satellite Model

H

HIST	History
HO	History Office
HQ	Headquarters

I

IBID	Ibidem, In The Same Place

K

KTTC	Keesler Technical Training Center

L

LAN	Local Area Network
LTR	Letter
LTTC	Lowry Technical Training Center

M

MAJ	Major
MEMO	Memorandum
MFR	Memo For Record
MSG	Message

N

NASA	National Aeronautics and Space Administration
NORAD	North American Air Defense Command

O

OL	Operating Location
OPS	Operations
ORI	Operational Readiness Inspection

P

P	Page
PA	Public Affairs
PAD	Program Action Directive
PGL	Program Guidance Letter
PP	Pages
PPR	Paper
PROG	Program
PT	Point
PV	Privileged

R

RPT	Report

S

SAF	Secretary of the Air Force
SAV	Staff Assistance Visit
SCHS	School Squadron
SEC	Section
SGT	Sergeant
SO	Special Order
SOSOC	Space Operations Staff Officer Course
SP	Space
SPACECMD	Space Command
SPACETNGSQ	Space Training Squadron
SQ	Squadron
SSS	Staff Summary Sheet
SUBJ	Subject
SUM	Summary
SYS	System

T

TCHTG	Technical Training Group
TCHTS	Technical Training Squadron
TCHTW	Technical Training Wing
TDY	Temporary Duty
TLKG	Talking
TNG	Training
TT	Deputy Chief of Staff for Technical Training
TTGX	Operations Division
TTGXS	Space/Audiovisual Branch

U

U	Unclassified

UEI	Unit Effectiveness Inspection
USAF	United States Air Force
USSPACECOM	United States Space Command
UST	Undergraduate Space Training

X

XP	Deputy Chief of Staff for Plans and Requirements

W

W	With

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